NUST ANNUAL SDGs REPORT 2022



Table of contents

Introduction	3
THE IMPACT Rankings	4
Nustainable Team	6
Flagship achievement - establishing 5G LABS at NUST	7
SDG # 1: No poverty	11
SDG # 2: Zero Hunger	15
SDG # 3: Good Health and Wellbeing	19
SDG # 4: Quality education	26
SDG #5: Gender Equality	36
SDG #6: Clean Water and Sanitation	39
SDG #7: Affordable and Clean Energy	45
SDG #8: Decent work and economic growth	52
SDG #9: Industry, innovation and infrastructure	57
SDG #10: Reduced inequalities	64
SDG #11: Sustainable cities and communities	68
SDG #12: Responsible consumption and production	72
SDG #13: Climate Action	76
SDG #14: Life below water	82
SDG #15: Life on land	85
SDG #16: Peace, Justice and strong institutions	89
SDG #17: Partnerships for the goals	91

Introduction

This report covers the sustainable initiative of National University of Sciences and Technology (NUST) from the academic year 2021 (August) to 2022 (June).

The sustainability report mainly focuses on the university's key areas of SDG alignment which has been mapped prior from the year 2018 till date, tincluding research and innovation, academics, youth engagement, operations, governance and community engagement.

It also highlights the research projects from all of the schools of NUST directly working for the achievement

of sustainable development goals at national and international levels, addressing pressing issues like: climate change, health, dwindling economies and technological advancement. The recognition of this work has been noted by THE Impact ranking of NUST in the year 2022 and its community engagement in the national cause, which is discussed in further detail along the report.

We believe that you will find this report useful and informational regarding NUST and its current research trends. We look forward to receiving your feedback on the report that would enable us to communicate our annual SDGs advancements with you.

For more information, contact office of sustainability, RIC, NUST. Email: ad.sustainability@nust.edu.pk Website: https://sdgs.nust.edu.pk/



@Nustainable

THE IMPACT RANKINGS

SDG No. & Description	World Rank 2020	World Rank 2021	World Rank 2022	Domestic Rank 2021	Domestic Rank 2022
SDG 1: No Poverty	201-300	401+	201-300	4th	5th
SDG 2: Zero Hunger	201+	301-400	301-400	3rd	4th
SDG 3: Good Health and Well being	401-600	601-800	801-1000	4th	7th
SDG 4: Quality Education	70	101-200	101-200	2nd	4th
SDG 5: Gender Equality	201-300	401-600	401-600	6th	6th
SDG 6: Clean Water and Sanitation	201-300	101-200	101-200	1st	1st
SDG 7: Affordable and Clean Energy	101-200	67	4	1st	1st
SDG 8: Decent Work and Economic Growth	101-200	201-300	201-300	2nd	2nd
SDG 9: Industry, Innovation and Infrastructure	101-200	201-300	201-300	1st	1st
SDG 10: Reduced Inequalities	301-400	401-600	401-600	3rd	3rd

SDG No. & Description	World Rank 2020	World Rank 2021	World Rank 2022	Domestic Rank 2021	Domestic Rank 2022
SDG 11: Sustainable Cities and communities	301-400	401-600	301-600	2nd	1st
SDG 12: Responsible Consumption and production	78	101-200	67	1st	1st
SDG 13: Climate Action	301+	201-300	201-300	2nd	4th
SDG 14: Life below Water	201+	201-300	62	1st	1st
SDG 15: Life on Land	201+	201-300	101-200	2nd	1st
SDG 16: Peace, Justice and Strong Institutions	301-400	401-600	401-600	1st	2nd
SDG 17: Partnership for the Goals	101-200	201-300	201-300	1st	1st
Overall	201-300	201-300	101-200	1st	1st

NUST SDG Report 2022 | 5

Nustainable Team



Universities hold an invaluable role within societies since they contribute towards the sustainable development goals through: education, research and innovation and collaborations with industries. NUST has established one of Pakistan's first office of sustainability – Nustainable to carry out long term strategy aligned with the sustainable development goals, including the university's aspirations to becoming carbon neutral by 2030. The team is comprised of the head of sustainability, Ms. Ameera Adil, along with her team: Ms. Abeera Babar and Mr. Zia-ur-Rahman.

The Nustainable team has been working on youth engagement, advocacy and partnerships to host educational events at the university and facilitate the participation of young climate activists on campus. They have since established a student 'Youth Pannel' to bridge the gap between policies implemented on campus and beyond with the perspective of the next generation. The office aims to promote knowledge diffusion regarding climate change and sustainable practices, mobilizing the youth to be the agents that bring this change. On a larger level, the office is an institutional platform for international partnerships to promote interdisciplinary research and address the challenges faced within implementing the Sustainable Development Goals (SDG)'s.



Flagship achievement establishing 5G LABS at NUST

Pakistan's first 5G Innovation Lab was established at NUST in partnership with Jazz, Pakistan's digital operator. The 5G innovation lab strives to work on potential security related concerns, along with the emerging fields of artificial intelligence, virtual reality, cloud computing with applications in education, healthcare, industry and agriculture. 5G networks advance energy efficiency as compared to previous wireless technology, which can lead to more efficient base stations, network



infrastructure and devices reducing overall energy consumption and carbon emissions.



Formula Electric Racing NUST (FERN) × Tesla Collaboration

Formula Electric Racing NUST (FERN) from Pakistan Navy Engineering College (PNEC-NUST) has received technical sponsorship from Tesla. FERN is the first and only Formula Student team from Pakistan to receive this sponsorship from Tesla, which is given to Formula Student teams from all over the world. Along with providing technical support, Tesla will give FERN a 5000-euro discount on enepaq Timbys, ADI & TI, BMS chips, and development boards.



8 | NUST SDG Report 2022

4th in the World









NUST SDG Report 2022 | 9



Congratulations

NUST becomes South Asia's 1st university to receive the Pandora instrument as a part of **Pandonia Global Network (PGN)** which provides Real-Time Air Pollution Data, under the lead of **Professor Dr Fahim Khokhar** of the School of Civil & Environmental Engineering (SCEE)



NSTP was founded with a vision to become a thriving and dynamic international hub for scientific and technological R&D and innovation, by facilitating collaboration amongst research centers, universities, industry, communities, and Governments, and creating products and services with positive economic and societal impact within the region and beyond.

\$830000 Funding Raised by Entities

2500000000 PKR Revenue Generated by Tenants

1500 Knowledge Workers

85 IPs Generated & Identified



No Poverty11444Research ProjectsPublicationsPatents

NEED Based Scholarships: **Unlocking Opportunities**

NUST strives to maintain inclusivity and encourage empowerment through education through the NEED initiative, awarding scholarships to all university students who enter on merit. Approximately 60% of NUST's student population comes from lower-middle income backgrounds and the NEED initiative works through various routes including endowment building and adopting a scholar program. Till date, a total of 5143 need-based scholarships have been awarded, aiming to unlock opportunities and eradicate poverty, this is SDG 1 in action: the hard work NUST aims to deliver by giving necessary financial assistance to students by eradicating economic barriers in their educational journey.

Class / Program	No. of Students
Undergraduate (UG)	3548
Postgraduate (PG)	1595
Total	5143



NCSC Clothes Donation Drive

NUST Community Services Club conducted a campus-wide Clothes donation drive to donate at F-6 Christian Colony Islamabad, where 18 volunteer students transported the donated clothes that were collected from students all over the university. This is aligned with NUST efforts in building inclusive and sustainable communities, no poverty: no limits. Protecting the less fortunate with clothes for the winter and providing basic needs adds to the ongoing humanitarian mission.



NCSC Visit to Najaat Trust

NUST Community Services Club in collaboration with the team at TABA visited Najaat Trust, an old age home located in Rawalpindi. A group of 25 volunteer students spent the evening with the tenants; playing games like Ludo and listening to their stories. NUST encourages inclusive growth which involves breaking the cycle of poverty to one of possibility and inclusivity - the benefits of economic development should be shared equitably, time being the most valuable currency.



14 | NUST SDG Report 2022



GOAL 2

Zero Hunger5423218Research ProjectsPublicationsPatents

Zero Waste in Olive oil Production

Through funding secured from the Pakistan Agricultural Research Council, NUST researcher Dr. Salman Raza Naqvi and Dr. Muhammad Shahid developed a technique for processing olive fruit waste and extracting leftover oil for edible use. The research promotes sustainable practice in the olive oil industry and reduces environmental impact by maximizing the use of olive oil fruit waste, contributing to the goal of zero hunger.

Harnessing the Power of Multifaceted Crop Scouting for Crop Insights

The multifaceted crop scouting industry 4.0 is a project conducted by Dr. Sajjad Hussain that aims to enhance crop management through machine vision, spectral imagery, and IoT (Internet of Things) solutions. The technology combines RGB and hyper-spectral cameras mounted over plant beds to capture multitemporal images for food analysis, allowing researchers to predict plant health and estimate yield. Through the promotion of sustainable farming methods, NUST aspires to enhance productivity, preserve ecosystems and reduce the environmental impact of food



production. Along with this, soil sensors are utilized to measure soil quality. Advancements in technologies like these allow for harvesting hope, ensuring food for all generations.



Safeguarding Harvests Through IoT

NUST research conducted by Dr. Rafia Mumtaz has produced means of monitoring crop health in real time using Internet of Things (IoT) enabled precision agriculture. A multi-spectral camera is mounted on a drone to acquire spectral images, these images facilitate the integration of IoT sensors and NDVI images to generate crop health maps, contributing to ending hunger. Prevention is better than cure: this project is looking at sustainability within agriculture, from the farm to the fork. By catching the health status of crops in real time, it enables farmers with the current knowledge regarding their harvest and allows for more productive farming techniques.





FROODS Team

NUST Community Services Club in collaboration with FROODS conducted a food drive at Muslim Colony Islamabad. The partnership was a small step in establishing that a plate full of promise can be given, bridging the food gap between the underprivileged. FROODS sustainable mission plan is to aid in global security by reducing food insecurity, the student volunteers aided that mission to contribute to social cohesion and sustainable development.

NCSC Ration Drive

Access to nutritious food is vital for good health and overall wellbeing - Zero Hunger also advocates for a balanced diet and better nutrition globally. NUST Community Services Club conducted a two-week long ration drive, collecting 344, 500 PKR to put food on the table for 80 families. The students were excited to be the seeds of transformation, aiding the global commitment to end hunger - campus wide, volunteers from different disciplines participated in the collection and delivery process of the ration packages.



18 | NUST SDG Report 2022



Good Health and Well-being 140 1290 252 Research Projects Publications Patents

Research as a commitment to a better world

Quick Connect - Wound Closure

NUST researchers Dr. Muhammad Shoaib Butt and Dr. Muhammad Bilal Khan Niazi have developed the implementation of skin stapling for wound closure in emergency department, which addresses the need for innovative solutions for effective wound closure techniques in the treatment of patients within emergency situations.

Active Drive

NUST researcher Dr. Muhammad Usman Akram developed a detection system for driver drowsiness that specifically looks at improving road safety by detecting the levels of drowsiness and preventing accidents caused by fatigue; contributing to enhanced wellbeing and health through improved road safety.

Robo-Assisted Healthcare

In partnership with IGNITE, a contribution from researcher Dr. Mohsin Islam Tiwana from CEME: the development of a human interaction robot with medical instrumentation improving patient care, wellbeing and healthcare accessibility. The robot adds to integration of technologies within healthcare settings, advancing sustainable development in healthcare sector. Along with this, IGNITE funding allowed NUST researcher Dr. Muhammad Usman Akram at CEME to develop an Epilepsy monitoring band that empowers individuals with epilepsy and monitors seizure control.

DigiHealth-Asia

An ambitious project under Dr. Rafia Mumtaz pushes boundaries in the capacity for digital health monitoring and care systems within Asia. The project develops training programs for healthcare practitioners to enhance ICT-based patient monitoring for assistive technologies for healthcare practitioners, researchers, and teaching staff. The project is focused on creating sustainable networks though the development of digital technologies for healthcare. indoor air guality and prediction of future guality of air, contributing to the environment of the

indoor air quality and prediction of future quality of air, contributing to the environment of the campus and working towards healthier lives through healthier air.

20 | NUST SDG Report 2022

Safe Infants Through Smart Technology

Dr. Shibli Nisar leveraged artificial intelligence technologies to create a smart infant monitoring system which promotes the healthy development and safety of children, along with reducing the risk of health complications – advancing healthy lives for the youngest and most vulnerable members of society.

Tremor Detect - Quick Action

Mr. Bilal Rauf devised a tremor detection system through wearable devices that enables the early detection, intervention and treatment of conditions like Parkinson's disease: enhancing healthcare accessibility and promote wellbeing at the initial stage disease onset.

Health Parameter Monitoring

Dr. Syed Sajjad Haider Zaidi implemented field programmable gate arrays (FPGA) to enable real-time monitoring of transformer health parameters. This research helps prevent transformer failures, improve maintenance practices and ensures an uninterrupted supply of electricity, helping in the overall goal of ensuring healthy lives and wellbeing for all.

Typhoid Tetect: New Tech

Dr. Usman Khan aided in the development of an electrochemical sensor for typhoid by making a portable and rapid diagnostic tool for its detection - this helps reduce the burden of typhoid, improve treatment outcomes and prevent the spread of disease by enhancing access to timely diagnosis.

Smart Wheelchair Cushions

Dr. Sana Waheed fashioned a Smart wheelchair cushion that incorporates advances sensing and pressure distribution technology to enhance comfort and prevent pressure ulcers and improve the overall wellbeing for wheelchair users by promoting physical comfort.

Healthier minds - Healthier Societies

Dr. Jawwad Zaidi created a system for overcoming overthinking to address mental health challenges associated with overthinking like anxiety and stress where individuals can experience improved well-being and emotional resilience.

Indoor Air Purifier System

A product created through the technological breakthroughs of air quality enhancement and tracking, Dr. Rafia Mumtaz launched a sensorbased indoor air purifier system that monitors and controls the quality of indoor air - the system senses key parameters including CO2, particulate matter, temperature and humidity. After initial recording, it engages a controlling mechanism to circumvent the quality of air, through a UV purification chamber and humidifier. The device shows real-world application within the vital link between air quality and wellbeing - breathing easier, and living better.



Awards and Grants for Health & Wellbeing

Under the Higher Education Commission's National Research Program for Universities, NUST assistant professor Dr. Owais Anwar Golra was awarded a research grant for 4.1 million PKR to facilitate the research about digitization of public and private hospitals in Pakistan, exploring the barriers and facilitators of this process in developing economies containing a complex healthcare infrastructures. In addition to this, through the International Committee for the Red Cross, Dr. Golra was also sourced for consultancy and awarded 1.5 million to perform a situation analysis on the physical rehabilitation policy currently available under the Sehat Sahulat Health Insurance program in Pakistan.

Health in harmony: building from wellbeing education

Psychoeducation: C3A and Pakistan Red Crescent

Students from the department of behavioral sciences utilized their internship at Pakistan Red Crescent under supervision the of practicing councilors from NUST Centre for Counselling & Career Advisory (C3A) to conduct informational sessions within public schools in Islamabad. The teenagers were



provided with an opportunity to learn about stress and anger management, as well as gain awareness and guidance on career choices through these informational sessions. The project was directly involved with the community and aimed to promote wellness and education for everyone, leaving no one behind in building a healthier future.

Seminar on International Sign Language Day

NUST Bio Reach Society in collaboration with DeafTawk's Executive officer, Mr. Ali Shabbar provided a platform for more than 80 students to engage with raising awareness, fostering collaboration and inspiring action towards achieving the goal of good health and well-being for everyone. Promotion for health for all people of all abilities paves the way for a prosperous and thriving society. Along with this, a webinar on physical therapy



was given by inviting guest speaker Dr. Sidra Ali Naqvi in conducting a physical therapy and awareness camp.

Pink Ribbon campaign - Health as a Human Right

NUST Community Services Club partnered with Pink Ribbon and successfully conducted a Breast Cancer Awareness drive where education and support were given for breast cancer survivors - along with this, an extensive social media campaign initiated the reminder for self-exams within the community. 'Pink day' was observed where students wore pink in awareness and solidarity for the cause. From illness to wellness, the students of NUST are committed to promote the education of healthier, sustainable living.



Lifeblood for sustainable health: Blood donation drives in support for wellbeing across the lifespan

Blood Heist

NUST Bio Reach Society collaborated with Shaukat Khanum Memorial Cancer Hospital and Research Centre to aid in the treatment of a large number of blood cancer patients within the hospital. The blood donation drive strove to promote health as a human right and a foster a dedicated commitment to a better society – blood cancer



is widely recognized as the prevalent form of cancer affecting children worldwide, including Pakistan. A total of 90 pints of blood were collected and donated: The blood heist supported the expert care from specialists in the field to treat fellow community members.

Uniting for Lifeblood: NCSC x TABA

NUST Community Services Club partnered with TABA Youth Chapter to donate blood for Sundas foundation in an effort to aid in the quality of treatment for patients suffering from thalassemia, hemophilia and other blood disorders. The collaborated efforts along with participation from university students showed the enthusiasm the student population has in empowering lives through blood donation and contributing to better health and wellbeing of the community. A total of 30 pints of blood were collected for the foundation.





OualityEducation14145517Research ProjectsPublications

NUST 360-Degree Financial Aid Program

To provide quality education, first and foremost to the students of the university themselves - NUST caters to collect information on financially disadvantaged students of NUST to appropriately grant scholarships to eligible students on its various campuses. Through documentation requirements, on-site verification and interviews, eligible students can take advantage of the financial aid program. The initiative has already benefited more than 5000 students, opened doors of opportunity and empowered them to pursue their academic dreams.

NUST Programmes and Labs

NUST has 29 undergraduate, 69 master's and 45 PhD programmes with a total of 143. These progammes enriches the students with the advanced syllabus of discipline, practical experience in the state of art labs and in house exposure with the diversity of students clubs, industrial visits and with placement in the different companies.

NUST has 18 x constituent institutions spread over Islamabad, Rawalpindi, Risalpur and Karachi with a total of 351 x labs to support Undergraduate (UG), Master of Science (MS) and Doctor of Philosophy (PhD) programs. These labs have been grouped in 4 x categories i.e., Teaching, Research, Final Year Project and General Purpose Labs and NUST invests a handsome amount of its budget to keep these labs updated and 100% functional to maintain the high quality in academics and research.



Professional Development Centre (PDC) NUST

Professional Development Centre (PDC) was established by NUST in July 2007 under an initiative of Higher Education Commission (HEC) to provide continued education and professional development services to industry. At PDC we strive to let our learning partners conquer the challenges they face in rapidly changing environment. PDC has trained more than 18000 employees and performed more than 700 industryfocused workshops to far, building a sizable customer of more than 800 firms. PDC is utilizing a strong faculty foundation of more than 1200 NUST members, including more than 600 PhDs.

4 4 4

PDC NUST Signed a Memorandum of Agreement (MoA) with BF Technologies

NUST Professional Development Centre has signed a Memorandum of Agreement (MoA) with BF Technologies with an aim to enable our youth & professionals to develop lifelong eCommerce skills that promote E-Employment and will assist in getting Pakistan's economy back on track.



NUST SDG Report 2022 29

NUST Central Library

Along with 17 institutional libraries in various NUST campuses across Pakistan, a state-of-theart Central Library has been established in H12 Islamabad Campus to store more than 350,000 volumes and e-books and 80,000 periodicals and e-journals. To encourage a reading culture, enable group studies, and perform training in citation management, information literacy, and search management, this facility is available to NUST students, professors, and staff.



Group Study Room

The NUST Central library offers the service of group study rooms to meet the demands of the students who need to engage in group-study and conversations while working on group assignments or projects. Additionally, the facility aids in reducing noise levels in other library sections, allowing patrons to read and work quietly.



NUST Library Mobile App

NUST central library has a mobile application, that can be downloaded from play store and can be accessed by the login by your library account. This can be used to see the available books, catalogue and can do a request for book as well.





Self-Service Kiosks

The NUST Central Library has converted to a self-service check-in and check-out system using Radio Frequency Identification (RFID) technology. To issue or renew their required books from the library, Central Library users can now use a self-check-in kiosk and either their NUST ID cards or biometric identification.

Student Clubs and Societies

NUST prides itself to have multiple dedicated clubs and societies that engages the diverse student body. NUST strives to develop skills in their students that foster creativity, innovation and leadership qualities to equip the future of our generations to tackle global problems. With the Student Affairs and Counselling Directorate, 35 established student societies for students to engage with, that include:

- NUST Bazm-e- Pakistan (NBP)
- NUSTAdventure Club (NAC)
- NUST Environment Club (NEC)
- NUST Science Society (NSS)
- NUST Literary Circle (NLC)
- NUST Book Člub (NBC)
- NUST Community Service Club (NCSC)
- NUST Dramatic Club (NDC)
- NUST Debating Society (NDS)
- NUST Media Club (NMC)
- NUST Fine Arts Club (NFAC)
- NUST Bio Reach Society
- NUST Entrepreneurs Club (NEC)
- NUST Leaders Society (NLS)
- NUST Excursion Club (NEC)
- NUST Digital Club (NDC)

- NUST Water Sports Club
- NUST Technical Amusement Club (NTAC)
- NUST Paragliding Club
- NUST Robotics Club (NRC)
- NUST Quiz Club (NQC)
- International Chapter (SCME)
- NUST Trekking Club (NKC)
- NUST GeneUs
- NUST Archery Club (NAC)
- NUST Cultural Club (NCC)
- NUST Fitness Club (NFS)
- NUST Physics and Astronomy (NPA)
- Institution-based Clubs and Societies
- NUST Ni Hao Club
- IMEchE
- NUST Hack Club



NUST Outreach Program 2022

As part of the #NUST Undergraduate (UG) Admissions Outreach, the #NUST Admissions Directorate participated in the College Fair held at Beaconhouse College Program Tipu Sultan Campus, Rawalpindi, DHA Islamabad Education System, and APS Fort Road Campus, Rawalpindi and also in the Education Expo at Cadet College Hassanabadal.



'Lincon Corner' Established at NUST Library

The Lincon Corner at NUST was established through Rector NUST and US Ambassador to Pakistan, Mr. Donald Blome that signed a memorandum of understanding during the inauguration of the Corner. The facilities provided to the students of NUST H-12 campus from the Corner include print and multimedia resources, a 3D printer; heat press; laser cutter and VR equipment. The Corner is a facility that students across the campus can benefit from and introduce themselves to new technologies.



Book Asylum: Library Donation

NUST Community Services Club in collaboration with the Youth team at TABA foundation collected books from NUST university students, and built a library at Muhammadi Foundation, Islamabad. The 'book asylum' was a two-week long event where student volunteers gathered donations for books, and 20 students participated though visiting the orphanage to spend the day while they set up the library. The collection of books



donated will serve as lifelong learning in benefiting the children and promote literacy in the area, promoting for equal opportunities for education.



Project 'Elevate': Founding the Bardasht School Computer Lab

NUST Community Services Club organized a project to build a computer lab within an underprivileged school. To bridge the technological divide and reduce inequalities regarding the access to technological advancement, project 'Elevate'

was a campus wide project that required 200 student volunteers to set up a computer lab at the school. The new computer lab at Bardasht school will create an environment that promotes information communication technology (ICT) literacy and prepares young minds for the digital age.

Workshop on Characterization Techniques for Nanomaterials

Team U.S.-Pakistan Centre for Advanced Studies in Energy at NUST organized their 3-Day Workshop on the Hands-on Experience of Characterization Techniques for Nanomaterials at USPCAS-E from September 7-9, 2022. More than 60 national and international participants from industry, academia, and strategic organizations took part in the 3-day training. The workshop included hands-on training sessions in one of our state-of-theart Advanced Energy Materials and Systems (AEMS) lab.



NUST SDG Report 2022 35



Gender Equality 42 164 06

Research Projects Publications

Patents
'BaatCheet' - Inclusivity for the Transgender Community

NUST Community Services Club held an interactive event 'BaatCheet' which focuses on issues faced by the transgender community of Pakistan, inviting a guest speaker panel to converse with and educate the NUST student population regarding the struggles the community faces despite the 2018 Transgender Persons (Protection of Rights) Act of 2018. Over 100 students from the campus attended the event at the coffee lounge to learn from the valuable stores the guests had to share.



Amnesty International's 'Write for Rights' Event

The 'Write for Rights' event was funded by Amnesty International in collaboration with NUST Community Services Club to allow students from across the campus to participate in writing for

change. Guest speaker Mr. Usama Khilji, a consultant with the United Nations Information Center in Islamabad was invited to encourage the students to write about the inequalities they may face and reinforced the power of writing within the student population. Building a future of gender equality includes embracing change by empowering young voices.



NUST SDG Report 2022 37

Women in Engineering Hosting **'International Women's Day'**

NUST Student Society in campus PNEC hosted an international women's day seminar on 8th March to celebrate the different experiences women in STEM and engineering contribute. The seminar had a unique audience of high-achievers within college campuses around Karachi who were selected to attend the seminar to celebrate international women's day - a more inclusive world holding equal rights and equal opportunities, the talk was a milestone in unleashing the potential of young female minds and breaking stereotypes, and inspiring change.



INTERNATIONAL Women's Day MARCH 8th



Clean Water and Sanitation

88 Research Projects Publications

562

Patents

27

NUST Master Plan on Water Management and Sewerage Network

A master design created by experts at NUST administration assures that all water supply lines have been installed on one side of the road and seepage lines on the other side to eliminate any possibility of combining drinking water and sewage. All water supply fittings and network lines undergo routine maintenance to prevent waste and ensure there are no pipeline leaks. Near IESE (SCEE), a 40,000-gallon underground water tank has been built to collect local rainwater and be utilized for drip irrigation.

- To retain rainwater that would otherwise rise the water table below the surface through seepage and be used for agriculture, NUST built three check dams.
- Two 250-foot-deep recharge wells have been built to replenish the groundwater through rainfall.



NUST Wastewater Treatment Plant

Water scarcity has emerged as one of the biggest risks to civilization today as a result of the global water shortages, making it one of the key sustainable development goals of the UN.

As a result, NUST wants to concentrate on creating new initiatives and technology to lower its water usage. Our researchers created and put into operation a wastewater treatment facility that uses lowcost technology and requires little energy and operational care to treat wastewater. Recycled water is used by NUST to completely fill its



Islamabad campus' horticultural water needs. NUST filters 80,000 gallons of sewage water per day using Wetland Filter technology with no energy use.

At the National University of Sciences and Technology (NUST), Islamabad, Pakistan, a full-scale membrane bioreactor (MBR) with a 50 m3/day capacity, submerged PVDF hollow fiber membrane (Cheil Industries, Korea), 94.8 m2 surface area, and 0.03 m pore size was installed to treat actual wastewater from a university campus.

This plant product water



is utilized for horticulture on the entire campus and fulfills the requirement for vegetation, demonstrating NUST's commitment to the sustainable development model.

IoT Enabled Water Pollution Detection for Predictive Healthcare

Dr. Rafia Mumtaz has developed an Internet of Things (IoT) enabled water quality parameter that generates a Water Quality Index (WQI) of a region of interest in real time. The system utilizes the classification based on bacteria prediction using machine learning algorithms, contributing to clean water and sanitation,

reducing the spread of waterborne diseases like diarrhea, cholera and typhoid.



Data-driven Resilience for Watershed at Monsoon Margins – Joint Projects of NUST Researchers

Through an esteemed sponsorship of 80,000 Euros from DAAD scholarships, NUST researchers Dr. Usman Ali and Dr. Hasan Arshad Nasir in collaboration with researchers from Hamburg University, LUMS and NAMAL partnered in a project securing socioeconomic stability and data driven resilience for ungauged Namal Valley Watershed at Monsoon Margins. The project enabled catchments with limited sensing, prone to torrential flooding, for effective forecasting and modelling to prevent disasters through effective management of small reservoirs taking Namal lake as an example. The multidisciplinary project proposed datadriven modelling, optimization and control to





researchers to control situations handicapped by limited sensing, like the exemplar case. The project actively showcased how climate change impacts water availability and exacerbates water-related challenges which can be overcome through innovative multidisciplinary technology to create climate resilience.

Sustainable Sources for Sustainable Solutions: Solar Power Purifying Water

Esteemed NUST researcher Dr. Sehar Shakir created a decentralized small scale water purification system for remote communities. The system runs on solar power, providing a streamlined approach to clean, green water through green energy: making waves of progress within the management of water resources and utilizing efficient water practices.



International Conference on Water, Energy and Environment for Sustainability

The 2nd International Conference on Water, Energy, and Environment for Sustainability (IC-WEES) was organized by the NUST Military College of Engineering (MCE), Risalpur at USPCAS-E, NUST.

The conference focused on issues such as catastrophe risk reduction, the relationship between water and the environment, and challenges brought on by climate change.



Clean Water Assessment – Removing Industrial Waste

NUST researchers Dr. Salman Raza Naqvi and Dr. Zaib Jahan engineered high-capacity MXene compositive for the removal of heavy metal within industrial wastewater. This solution offers an efficient and sustainable method for water treatment by having a higher absorption capacity to protect the management of water as a scarce resource.

Seminar on Food, Water and Energy Nexus

US Pakistan Center for Advanced Studies in Energy arranged a seminar in NUST for students to update themselves regarding the 'Food, water and energy Nexus' delivered by Dr. Warda Ajaz in June of 2021. The seminar encouraged students to partake in sustainable living for the future of environmental sustainability and engage in water-efficient practices.







Affordable and Clean Energy

55 Research Projects

Publications

431

Patents

59

Towards a Low-Carbon Energy Future

Researchers at NUST, Dr. Asif Hussain and Dr. Majid Ali were able to increase access to affordable, reliable, sustainable and modern energy for all through an innovative solution to address the need for clean hydrogen production – a crucial role in transition to a low-carbon energy future. They did this through the fabrication for a pre-heating system for a fixed bed steam reforming reactor for cleaner hydrogen fuel production.

Energy Efficiency in Microgrids

In partnership with North China Electric Power University (NCEPU), Dr. Sarmad Majeed Malik addressed the challenge associated with integrating renewable energy sources intro microgrids to enable efficient and reliable power management to promote clean and sustainable energy.

Sustainable Energy Storage

In partnership with the British Council and researchers stationed abroad, Dr. Zeeshan Ali has had the opportunity to explore the exploitation of sustainable metal chalcogenide anodes for high energy sodium-ion batteries (in collaboration with Dr. Juliana Morbec and Dr. Muhammad Soaib) to advance sustainable energy storage technologies. Along with this, he has partnered with Dr. Xiaolei Fan and Dr. Salman Raza Naqvi to utilize activated carbon electrodes from sustainable resource materials for economical Sodium sulfur batteries, activating more economical energy storage systems.

Reusable and Safe Storage Methods

Research conducted by Dr. Adil Mansoor has created ground in environmental control and energy security through the synthesis of high surface area nanoporous ceramic materials decorated with metal particles using hydrothermal methods. The project achieved a funding of 8.3 million Rupees from HEC-NRPU which changed the synthesis process to determine composition, crystallinity, weight loss, porosity, surface area and pore volume of the materials to develop solid, shockproof and environmentally friendly hydrogen and CO2 gas storage materials that can be reused. This research aligns with the goal's access to reliable, sustainable and modern energy for all.

Fabrication of thin films using aerosol assisted chemical vapor deposition method

Fabrication of thin films using aerosol assisted chemical vapor deposition method





Transporting POL through Pakistan Railways

Within an industry implementation of Petroleum Oil Lubricant (POL) currently at Pakistan Railways (PR), research by Dr. Mujtaba Hassan Agha along with Dr. Muhammad Sabir and Dr. Muhammad Imran aimed to provide cleaner and more affordable means of transportation. Currently in Pakistan, POL products are imported and transported via road with smaller portions being transported through pipelines. The study highlights the opportunity for PK to transport POL products from ports to inland for use. Despite the PR's limited share within the regulated petroleum market there is potential for growth within the transportation of high-speed diesel (HSD) to destinations like Mehmood Kot and Taru Jabba. To improve these operations and adopt

modern practices, the utilization of technology can rolling maintain stocks and reduce turnaround time by updating tank wagon calibrations. This project promotes sustainable the and efficient transportation in the petroleum sector.



Consultancies Provided by NUST Researchers

Regarding the green energy conversation, NUST researchers have provided consultancy services and collaborations that reflect the nature of emerging technology within sustainable energy. Successful engagements include the collaborations with organizations like Mobiserve Pakistan Pvt Limited, the Islamic Relief of Pakistan (IRP), Saif Traders and the Ministry of Climate Change (MoCC). These partnerships showcase the expertise of NUST faculty in addressing the challenges faced by communities, in Pakistan and worldwide. Of particular note is Dr. Kafait Ulla who conducted a consultative session on the National Electricity Policy & Plan for formulation and implementation. Through his technical support on the strategic policies, and collaborations from international agencies, mechanisms have been developed for evaluating policy targets. Along with this were engaging dialogues between policy recommendations on green transport penetration and the relationship between household energy and poverty, working closely with the planning commission of Pakistan.

48 | NUST SDG Report 2022

NUST Projects Breaking Ground in Renewable Energy

NUST school SNS has published 9 influential papers to streamline the process towards an energy efficient tomorrow, their ambitious research projects showcase the enthusiasm the students have at developing better methods for energy generation:

- The development of a two-dimensional double transition metal carbides as superior bifunctional electrocatalysts for overall water splitting provides an efficient method for water splitting which is a key process in renewable energy production and storage.
- Conducting an electrochemical investigation of methanol oxidation on thin films of nickel oxide and its composites with zirconium and yttrium oxides to enhance the efficiency of fuel cells and contribute to clean energy generation.
- Studying the effects of substrate temperature on structural, optical, photoelectrochemical properties of thin films using AACVD technique to advance knowledge in materials for photoelectrochemical applications to facilitate sustainable energy conversion.
- Creating a composite approach to synthesize a high-performance carbon catalyst for optical and electrocatalytic applications to develop more efficient optical and electrocatalytic processes enabling clean energy technologies.
- Development of yttrium and iron oxide thin films via AACVD methods for photooxidation of water for sustainable and clean water splitting process.
- The fabrication of metal incorporated nickel oxide films for electrochemical oxidation of methanol to improve the efficiency of methanol fuel cells for clean energy utilization.
- Versatile fabrication of Binary composite thin films by AACVD synergistic photocatalytic effect to advance materials and technologies for efficient solar driven photocatalysis.
- A tri-metallic oxide photoanode with improved photoconversion energy to enhance the performance of photoelectrochemical cells for sustainable energy conversion

Developing Hybrid Materials for Energy Storage

Under the ambitious project undertaken by Dr. Manzar Sohais, the school of natural sciences has undertaken a project to develop organic and inorganic hybrid materials for renewable energy conversion and storage by designing electrocatalysts, photocatalysts, and hybrid porous materials - the project particularly focuses on hydrogen production and storage for applications in fertilizer manufacturing and hydrogen fuel-based vehicles promoting self-sufficiency and sustainable energy systems.

Through both institutional collaboration and the involvement of skilled researchers from Pakistan and foreign universities, the project supports Pakistan's Energy Vision for 2025 and is aligned with the 2030 global agenda for sustainable development. Through harnessing the power of hydrogen fuel as a solar energy resource, the project can have a transformative impact on Pakistan's energy sector, ensuring that power supply, clean water provision through photocatalytic wastewater treatment and capacity building for students is achieved through extensive training and scientific exposure.



Workshop on Organic and Inorganic Hybrid Materials for Energy Conservation and Storage

NUST is proud to have collaborated with researchers from foreign universities like Dr. Amtiaz Nadeem from SABIC, KAUST and Dr. Shahid Rasool from Northumbria UK along with his PhD student Ms. Anosha Rubab gave NUST students valuable insights on various energy development topics including water splitting to produce hydrogen and the importance of

electrochemical recycling of carbon dioxide. Al local universities also presented their ideas for th including Dr. Raja Shahid Ashraf from GC Univer: research assistants from NUST including Ms. Sun involved in the education of students worldwide.



USPCAS-E NUST Clean Energy Seminars

NUST faculty in collaboration with U.S-Pakistan Center for Advanced Studies in Energy (USPCASE-E) a national conference was held at the Marriot Islamabad titled "Clean energy integration in CPEC" where guest speaker Mr. Ali Muhammad Khan was an attendee from the National Assembly of Pakistan. The objective of the event was to create awareness for the business community regarding clean energy and climate change, and facilitate the 'Green Growth' of Pakistan. NUST researchers Dr. Naseem Iqbal and Dr. Adeel Javed delivered speeches regarding batteries for electric vehicles and hydrogen applications.

Virtual Conferences on Sustainable Energy

In addition to this, USPCAS-E, NUST and the Chemical Reaction Engineering Group & School of Chemical & Energy Engineering at UTM organized an international virtual conference for sustainable energy and catalysis aiming to facilitate a platform for higher energy change that is eco-friendly. The conference attracted more than 30 presenters with 232 registrations in total from 18 different countries, showing the global efforts of NUST to establish climate action and sustainable energy efficiency worldwide. This was followed by USPCAS-E NUST alumni and industrial talks which benefit enrolled students with the latest knowledge of energy efficiency in practice. A series of workshops and a summer school was also arranged for NUST students in particular to benefit from, allowing the students practical exposure to the green energy shift.



Decent work and Economic Growth

47 Research Projects

209 Publications

25 Patents

Teach for Pakistan -Leadership Seminars

To provide equitable education is to empower communities-NUST faculty have been involved



in encouraging students to participate within the prestigious 'Teach for Pakistan' (TFP) Fellowship program, by holding informational seminars and inviting guest speakers like Ms. Rahat Abbasi, a senior professional at TFP. Along with this, other sessions include the guest speech made by Dr. Faisal Bari, the interim Dean LUMS School of Education to give a talk regarding "Classrooms to Systems: Bridging the Education Leadership Gap." By hosting these conferences for students to attend, learn and benefit from, NUST ignites leadership within the quality education sector to nurture young minds and transform societies.

Resource Consultancy for KPPRA Employees

NUST professor Dr. Mujtaba Hassan Agha has been selected as a consultant among the HRDC-IMSciences new initiative to provide industry training for Khyber Pakhtunkhwa Public Procurement Regulatory Authority (KPPRA) civil servants of KPK. The initiative focuses on enhancing the capacity of the corporate and public sector within the domains of supply chain management and procurement. Dr. Agha provided training to qualified students under the program regarding inventory management, supply chain network design (SCND), sales and operations planning (S&OP) and Demand Management. The chosen faculty aided within the continuous learning and capacity building of lesser advantaged students and aided in Pakistan's goal to create a workforce that is well-equipped in today's globalized and interconnected world; pushing boundaries to achieve the vision of inclusive quality education for all.



NUST SDG Report 2022 53

NUST Alumni Network

NUST's commitment to making an impact in the world is demonstrated in the vast range of opportunities our graduates have gone on to enjoy. NUSTIANS are synonymous to leaders, opinion makers, and change agents in their rewarding careers. NUST Alumni Network is 32,330 members strong and spread across 64 countries. The alumni network enhances the student lifecycle via numerous activities that include webinars, mentorship, internships, projects and contributors to the need based financial assistance programme and a environment of equal growth and prosperity.



NUST Placement Services

NUST University aids student development by providing opportunities for placements in industry - with more than 500 recruitment drives and up to 1200 industries engaged within the last seven years, NUST students have a 91% employment rate as per QS ranking criteria and is ranked as Pakistan's No. 1 University in the employer's reputation. The students are polished with skills that would transfer seamlessly into the industry where recruiters can notice talent at the on-campus recruitment drives. The industry sessions and alumni talk series occur on all branches and are an engaging opportunity for all.

54 NUST SDG Report 2022

NUST Career Concert 2022 - 23

The NUST Placement Office organized the two-day NUST Career Connect event in the federal capital to give graduating students the chance to network with potential employers and help those organizations achieve their human resources needs.

On Career Connect, more than 100 companies from the banking, development, construction, education, healthcare, hospitality, manufacturing, telecommunications, textile, information technology, FMCG, and other sectors appeared to recruit students from the engineering, biosciences, architecture, business, accounting & finance, social management sciences, sciences, and humanities fields. Mobilink Microfinance Bank Ltd, Defense Housing Authority, TPL Corp, S&P Global, Atlas Honda Group, Atlas Car Manufacturing, Ghulam Farugue Group, HUM Network Limited, FF Steel, Zong, Cheetay Logistics, and other renowned companies were among the top ones in attendance at the event. All the firms present at the event extolled

NUST for presenting its dynamic student pool to the job market and appreciated the students for turning out in large numbers.



NUST SDG Report 2022|55

NESCOM Team Conducted the Recruitment Drive





Arbisoft Recruitment Drive at SEECS NUST

56 | NUST SDG Report 2022



Industry, Innovation and Infrastructure

297809Research ProjectsPublications

828 Patents

NSTP Hatch-8 Programme

Hatch 8 programme is a 6-month pre-incubation program of #NSTP, which helps budding entrepreneurs transform their idea into viable businesses.

The National Science & Technology Park at NUST held the **Graduation Ceremony of the 3rd cohort of its Hatch 8 programme** at the NUST main campus on Thursday. As many as 16 startups built upon disruptive ideas have graduated as part of the third cohort. Hatch 8 is a cohort based pre-incubation programme of NSTP, which admits entrepreneurs at the idea stage of their product development and transforms them into viable businesses in due course of time.





Finding Innovative & Creative Solutions for Society **(FICS)**

1,000+ Startup Ideas Submitted

Successful Iterations

NUST is adamant about fostering an entrepreneurial and innovative attitude in students so they can meet today's issues. NUST hosts the yearly competition, Finding Innovative & Creative Solutions for Society (FICS), where students from all across the nation submit their concepts and working prototypes for funding and commercialization.

Through the platform Finding Innovative & Creative Solutions for Society (FICS), NUST students can use their technical expertise to benefit the communities in which they live. Therein, it is encouraged to identify social problems and use creative thinking to support technological solutions.

Startups GeoMINES, Inlights, and Bend Crete, in that order, made it to the top three spots. The are all a part of Hatch 8 Cohort 3, which is created especially for the growth of idea-stage startups. The program's startups are guided by professionals from Pakistan's startup ecosystem.



NUST SDG Report 2022 59

National Centre of **Artificial Intelligence** (NCAI), NUST Islamabad

NCAI is the latest technology initiative of the Government of Pakistan. The Centre is developed on

a consortium model consisting of 6 prominent public sector universities with 9 specialized research centres spread across Islamabad, Lahore, Karachi, Peshawar, and headquartered at NUST H-12 Islamabad.

NCAI has hosted the 2nd International Conference on Artificial Intelligence and keenly focused on the vision "To become a leading hub of innovation and scientific research in Artificial Intelligence (AI) and play a defining role in Pakistan's economy."



Workshop on Materials

A workshop titled "Materials World and the Importance of R&D" was hosted by NUST School of Materials & Chemical Engineering (SCME) on May 23, 2022. Dr. Adnan Syed from Cranfield University served as the workshop's main speaker. Throughout the session, several other UK



professors from Cranfield University gave virtual presentations on respective subjects.

The workshop's main emphasis was on the long-term viability of its materials. Discussions on a range of topics, including coating protection, imaging systems, nanotechnology, and techniques for material deterioration, were available to participants.

NUST Endowment – Empowering the Students

NUST aims to build resilient infrastructure and support inclusive industrialization; hence it fosters the innovative pursuits of students. Though the adoption of a futuristic, long-term approach, NUST enhances their students by aiming to increase its endowment size and hence increase the impact of the startup ecosystem at NUST: currently there are two types of endowments available, general (unspecified donations) or restricted (resources utilized for a defined purpose). The grant encourages entrepreneurs to polish, publish and execute their ideas within Pakistan and hence the university attempts to maintain talent retention and create a sustainable economic impact with a vibrant startup ecosystem to benefit Pakistan at large.



Agri-Damp: Prediction of Disease

In partnership with the National Center of Artificial Intelligence (NCAI) in NUST, researchers Dr. Rafia Mumtaz; Dr. Faisal Shafait and Dr. Muhammad Ali Tahir created 'Agri-Damp' – a system that revolutionizes crop disease monitoring and prediction through a combination of Internet of Things (IoT) and Artificial Intelligence (AI) technology. The predictive modelling informed through real-time data collection contributes to the promotion of inclusive and sustainable industrialization facilitated by innovation in tech.

Through IGNITE Partnerships (NUST x IGNITE)

After securing a partnership with IGNITE (National Technology Fund) prominent researcher Dr. Mohsin Islam Tiwana has created a system that uses Metal Inert Gas (MIG) welding techniques to enable efficient and cost-effective production of metal parts through



additive manufacturing, driving sustainable industrialization. Similar partnerships through IGNITE funding include:

- Dr. Syed Sajjad Haider Zaidi has ambitiously contributed in multiple projects firstly, the creation of a Pick and Place Robotic Arm that automates the process of picking and placing objects, enhancing the efficiency of logistical operations. Secondly, he has improved rapid charging capabilities for Batter Electric Vehicles (BEVs) to promote sustainable technology adoption. Thirdly, he has collaborated with Dr. Bilal Muhammad Khan to create an autonomous fire-fighting drone that improves response times and reduces risks for firefighters.
- Developing a remote monitoring system for temperature overseen by Dr. Imran Hafeez Abbasi; the solution to advanced temperature monitoring techniques enhancing safety and efficiency through remote infrared thermographic systems for remote monitoring of temperatures.
- Cooperative payload delivery systems using multiple quadrotor drones for sustainable transportation methods, especially in delivering payloads in remote areas by Mr. Jahanzeb Tariq.
- Developing algorithms for localization of time difference of arrival in hardware, a solution for accurate localization techniques enabling advancements in industries by Mr. Amir Fahad Malik.
- Creating a tester for avionics suite of trainer aircraft addressing the need for efficient and reliable testing tools to ensure proper functioning of avionic systems by Mr. Yahya aiding in developing reliable infrastructure.
- Designing smart antennas for millimeter-wave communication by Mr. Asim Jan for sustainable industrialization through effective communication.
- Forming flight drones in real time for coordinated operations in various industries by Dr. Qasim Ali.

62 | NUST SDG Report 2022

NUST Faculty Won the NESCOM Research Grants

NUST researcher Dr. Mustafa Anwar received three grants from the National Engineering and Scientific Commission (NESCOM) within Pakistan for the development of products aligned within sustainable development. Dr. Anwar's projects include surface modification for fiber reinforced composite for fair thermal stability and bonding (both phase 1 and 2) along with Zirconia coating on Ti-alloy and



ceramic substrates for enhanced thermal protection. Research has demonstrated breakthroughs in technological advancement by improving the thermal stability of reinforced composites contributing to the development of innovative materials and manufacturing processes within industry, through enhancement of the thermal protection of substrates. Projects like these allow for rich exchange of knowledge from different expertise researchers.

Projects for Promotion of Sustainable Innovation

Current research within NUST for the promotion of sustainable development includes the synthesis and characterization of polymeric emulsifiers to develop highly stable emulsions – in its use as a defoaming agent. Within Pakistan, the production of indigenous silicone resin emulsion paint (SREP) creates issues within paint industries however domestically produced polymeric emulsions benefit textiles. Stable emulsions are also required within the food industry; and have the potential to boost exports for oil drilling and glass treatment. Hence the development of a local production of silicone-based emulsion can improve industry performance and address trade deficits as an innovative and sustainable solution. Results of the ongoing research are in progress where synthesis and characterization of non-ionic silicone-based emulsifiers are being generated.



Reduced Inequalities

42 Research Projects

Publications

53

05 Patents

Leaving no one behind - empowering equality for all!

Inclusivity at the workplace – Informational seminar

NUST Business Alumni Ms. Amina Wahid and current head of Human Resources at Engro was invited to give an informational seminar on 'Diversity and Inclusion at the workplace: Where do we stand and what is the way forward?' Students in attendance were able to holistically capture the current image of Pakistan's inclusivity scope and understood the imminent need to bridge the gap towards more inclusive societies.

NCSC x TABA – Visit to Saya School Orphanage

NUST Community Services Club in partnership with TABA Youth group conducted an interactional visit through 40 volunteer students to the Saya School Orphanage. The visit inspired NUST students to take action towards reducing inequalities by sharing their experiences with fellow students to encourage more visitations along with advocacy for the orphanage's needs to address the root causes of inequality.



NCSC & Orphans Know More projects

NUST Community Services Club organized multiple visitations to different organization to conduct their event 'Orphans Know More'. A team of 30 NUST student volunteers rose to the occasion to visit different locations to target many vulnerable populations, including the visit to Noreen Zindagi Welfare Trust Orphanage and Mera Ghar orphanage. The primary goals of the visitations was to raise awareness of the challenges faced by orphan children, and promote inclusivity to demonstrate students wishing to interact with populations that are otherwise marginalized from mainstream society. This reduces inequalities as it provides care and support to children who face unequal opportunities.



66 | NUST SDG Report 2022

NCSC x NCBS Pakistan Sweet Homes

NUST Community Services Club in collaboration with NUST Character Building Society visited an orphanage, Pakistan Sweet Homes, with 25 student volunteers. The aim of the visit was to provide educational and career counseling to aid them in the professional world and provide motivation for the orphaned community to voice their concerns. Both the students and the children were part of a learning experience that promoted peace and stability within unjust social systems. The importance of equal treatment, respect for diversity and protection of human rights for all individuals was honored.





GOAL 11

Sustainable Cities and Communities

42 53 Research Projects Publications 05 Patents

NUST Prepared the Architectural Design Proposal for Resilient Community Rebuilding

After the havoc floods in 2022 that has caused massive destructions and Pakistan lost. The National Flood Response Coordination Center (NFRCC) was formed by the Prime Minister of Pakistan as part of the recovery effort following the disastrous floods. The center contacted several NGOs and academic institutions to make suggestions for the construction of model homes and shelters for the flood-affected areas.

The School of Civil and Environmental Engineering (SCEE), which served as the lead, and the School of Art, Design, and Architecture (SADA) collaborated on the plan that NUST submitted. While SADA was involved in the architectural design proposal for the Masterplan and the component habitats, SCEE was largely in charge of cost estimation and structural design.











NUST SDG Report 2022 69

Air Quality Monitoring Systems through IoT

SEECS, NUST has developed innovate real time air quality solutions - by utilizing IoT-based solutions, air contaminants are detected which include particulate matter, carbon dioxide, carbon monoxide, nitrogen dioxide and methane. The node monitors temperature, humidity, PM2.5 dust particles, CO, NO2, and CH4, and CO2. This data is uploaded to cloud storage for further analysis. The project allows for a deeper, nuanced understanding of air quality by utilizing a web portal to report air quality status and generating stats for the real-time condition when necessary. The system is accurately capable of classifying.

The designed node can use Wi-Fi technology to transmit real-time air quality reports to a web page, and it can also produce alarms when it notices anomalies in the air quality. Several machine learning algorithms have been applied to the recorded data in order to categorize the indoor air quality, with the Neural Network (NN) model outperforming all others with an accuracy of 99.1%.



NUST Startup (Inlights) Can Solve the Traffic Issues

The startup is working on indigenously developing Intelligent Transportation System. Features include adaptive traffic signal timings, priority routing for emergency vehicles, and central traffic control. Inlights whereas is a smart signaling solution to optimize traffic congestion. This one startup provides efficient and smart traffic management solutions for growing urban centers.





Responsible
Consumption and
Production
56and
321Research ProjectsPublicationsPatents
NUST Won the Project on Chemical Recycling of Plastic

One of the largest global issues of the twenty-first century is plastic pollution. In addition to polluting the environment, inappropriate treatment of plastic trash results in a significant loss of economic value. Recycling plastic garbage is thought to save 3.5 billion barrels of oil worldwide, or around £130 billion, in energy costs. By 2025, 70% of plastic packaging wastes in the UK are to be recycled or composted, according to the Plastics Pact by the Waste and

Resources Action Programme. Pakistan has the highest percentage of mismanaged plastic in South Asia, with 70% ending in landfills. A proposed project aims to produce valueadded chemicals from plastic waste using machine learning technologies like random forest and support vector machines.



The success will help address plastic pollution in both the UK and Pakistan.

Webinar on Plastic and Its Recycling

NUST School of Chemical & Materials Engineering (SCME) and NUST Office of Sustainability, in collaboration with PSF, UNDP, Global Water Challenges, UNESCO, and Coca Cola foundation have arranged a seminar on plastic waste and its recycling to highlight the pertinent existing issue and efforts needs to put forward by the organizations.



Recycling Glass in Material Management

Dr. Muhammad Irfan and Dr. Salman Raza Naqvi developed a means of recycling glass fibers from composite waste, allowing for high-tech applications. The research project addresses the challenges of composite waste disposal within the circular economy and aids in sustainable material management.

Upcycling Denim Waste

NUST researcher Dr. Owais Anwar Golra, in partnership with the British Council, has developed a combination of upcycling and chemical recycling technique to maximize resource efficiency for manufactured denim rejects - lessening the burden of textile waste within denim production and disposal.



Efficient Plastic Waste Management

NUST researcher Dr. Salman Raza Naqvi, in partnership with Pakistan Science Foundation (PSF) developed a lowcost plastic waste recycling machine to remote efficient and responsible management of plastic resources and products. By implementing these low-cost plastic waste machines, industries can actively participate in the circular economy to reduce plastic pollution.



NCBS Cleanliness Drive

NUST Character Building Society (NCBS) started a cleanliness campaign at NUST, with its first area of implementation at NUST Helipad Ground. The activity which engaged 30 student volunteers who were actively contributing towards waste management on campus. The activity also helped raised awareness on plastic pollution and disposable waste management, encouraging students to engage in healthier more sustainable waste disposable practices and recycle.





GOAL

Climate Action

99 Research Projects Publications

699

44 Patents

NUST Gets PANDORA Instrument from NASA to Access GEMS Satellite

By acquiring the most cutting-edge PANDORA equipment and access to the GEMS satellite from NASA for real-time air quality data monitoring, the National University of Science and Technology (NUST) once again brought honor to the nation.

As the first institute in the region to receive the tools needed to record, compile, and calibrate real-time air quality data, NUST not only received the most recent US National Aeronautics

and Space Administration (NASA) satellite but also joined the most cuttingedge geostationary orbit-based satellite observations (GEMS-G e o s t a t i o n a r y EnvironmentalMonitoring Spectrometer) of air quality.

Dr. Faheem Khokhar is also in charge of (climate change & atmospheric research group) C-CARGO group, <image><image><image><image><text>

that works with a pertinent focus on climate change adaptation and mitigation keeping in view the national problems of Pakistan.

Climate Change & Atmospheric Research Group

ΡΑΚΙΣΤΑΝ

COP27 in NUST

The NUST Research Directorate's Office of Sustainability hosted an event themed "COP27 at NUST" on December 21, 2022. The German Development Cooperation, Pakistan Red Crescent, and German Red Cross all worked together to organize the event. At the occasion, Mr. Asif Khan, Head of Office of GRC, spoke. Dr. Rizwan Riaz, Pro-Rector of RIC, also addressed this event.

Numerous students from several universities showed up for the occasion. There was a fun exercise where students had to come up with solutions to a problem statement about climate financing. The winning submission was chosen by vote.



COP27 in NUST | Organized by the Office of Sustainability, RIC

NUST Team Made CO2 Inhaling Bio-Healable Interlocking Compressed Earth Bricks

SCEE, NUST research team have come up with interlocking compressed earth bricks with suitable structural strength can be developed and composed by incorporating native soil bacteria, particularly the dominating strains of Bacillus safensis, Bacillus pumilus, Arthrobacter koreensis, and Arthrobacter luteolus. Improvements in strength to weight ratio, water absorption value, thermal conductivity, and component level strength are among the new characteristics. Earth bricks that are more thermally efficient as well as energy conservative. The study published with title "Carbon dioxide Inhaling Bio Healable Interlocking Compressed Earth Bricks".



TARA Foundation and Climate Change

Dr. Adeel Waqas, Principle at USPCAS-E NUST collaborated with TARA Foundation: the independent body of the European Climate Foundation which is solely working in Southeast Asia with its head office in Singapore. The details of this partnership were to discuss the ways through which energy transition could be promoted in Pakistan through creation, networking and advocacy and enabling strategy for the green energy shift that is noticed worldwide.



NUST SDG Report 2022 |79

NUST flood relief campaign

FOR DONATIONS

Account No: 2292 7917 3412 01 IBAN: PK82 HABB 0022 9279 1734 1201 Bank: HBL, H-12 Branch

In wake of the recent floods that afflicted Pakistan, student volunteers across campus aided through assistance packages for the 4,500 afflicted families to provide them with necessities. The strong sense of community and commitment was felt through the student body that rushed to help the public in wake of climate action and natural disasters. In times of crisis, the importance of social responsibility and solidarity were witnessed.

NUST 'Adopt a village' program

NUST

امدادی کیمپ برائے

سيلاب زدگان

نیشل یونیور می آف سائنسز ایند میکنالوجی، بلوچتان

The program aimed to provide long-term rehabilitation to one village in each province addressing challenges faced by the selected villages in wake of the floods. The rehabilitation efforts encompassed infrastructure restoration, healthcare services and educational opportunities through NUST student volunteer body and teaching professionals. Through working on different villages based on their specific needs, NUST empowers a sustainable future for affected communities.

80 | NUST SDG Report 2022

NUST Environment Club (NEC) at COP26

NUST environment club (NEC) in collaboration with Imperial College London held a live session in part of COP26 with the penal formed from USPCAS-E faculty and students to participate in discussions about a trans-disciplinary approach to promoting key drivers for resolving the climate-sustainability nexus and address climate change challenges. The students showed enthusiasm for gathering power to make the campus more climate friendly, greener and safer for all. The university is proud to foster these strategies towards stronger industry and academia linkages.

NEC x HBL Tree Plantation Event

NUST environment club (NEC) in collaboration with Habib Bank Limited (HBL) held a tree plantation activity - with the presence of the President of HBL Mr. Muhammad Aurangzeb, Rector NUST and other esteemed faculty. The tree plantation drive reminded students of the need for contributing to the ecosystem and improve air quality of the campus and beyond. Trees enhance water management, climate

regulation, aesthetics and wellbeing along with carbon sequestration - hence they are the active agents through which climate change can be managed through the atmosphere around campus.

Green Quest-Initiative to Engage Youth for Climate Action

NUST students actively participated at an eco-friendly competition held by NUST Environment Club (NEC) - 'Green Quest' was an exciting event that engaged students across the campus in various activities to promote thinking green and environmentally friendly means of conducting tasks.







Life below Water

81 Research Projects Publications

370

03 **Patents**

NUST Lakes-Enriched with Biodiversity

The NUST Lake is a beautiful location where students can escape their tedious schedule. Additionally, it is utilized to refuel the groundwater. With this captivating view located inside the college gates, one can retreat here and unwind. Its tranquility, which is frequently accompanied by the pattern of rain, enhances its worth by offering a refreshing setting to record your eternal memories beneath the azure sky and a seductive view of the blossoming landscape. This lake is not just a treat for students; it also serves as a haven for numerous species of lovely birds and vegetation.



Environmental Microbiology Research Group

At institute of environmental sciences and engineering (IESE) NUST, desginated research group focused particularly on the toxicological effects on the marine environment is assessed. The fishes exposed to control and experimental basin and mortality was observed against applied doses to identified LD50 for (24, 48, 72 and 96 hrs.) of exposure duration.

Aqua drone for water quality assessment

NUST researchers at ASAB have developed an 'Aqua Drone' device which is an advanced

intelligent system used to evaluate water quality parameters of an entire water body in real time. The device creates waves of progress within sustainable water consumption and use as it has a userfriendly dashboard, making it easier for water management and data collection. It operates using Internet of Things (IoT) technology creating an accurate prediction of Water Quality Index (WQI) using the

machine models, along with this the system allows for the visualizations of water quality conditions in machine learning models. The device enables better access to clean water and sanitation which is essential to human health, hygiene, and sanitation.







GOAL 15

Life on Land

9228513Research ProjectsPublicationsPatents

International Symposium on Use of New Agricultural Technologies

The Atta Ur Rahman School of Applied Biosciences (ASAB), NUST, organized a one-day international symposium and project launch for 2021-TURAGRIC-957 on building capacity for new technologies to reduce post-harvest losses.

At ASAB NUST, famous agricultural experts from around the world and the country came together to talk about post-harvest losses and ways to add value to crops to minimize them. In order to reduce post-harvest losses in the storage of horticultural products, new technologies were introduced, and training and capacity-building programs were closely tied to the proposed theme of the event.



Seminar on Forest Monitoring using 3D Modeling for trees

The use of optical satellite sensors for monitoring and change detection in forests was explored by the participants. They talked about the difficulty of combining high-resolution UAV data with open-access temporal data in Pakistani forest zones. The creation of 3D point cloud datasets made possible by UAV technology, ushering in a new era of forest monitoring methods, was the fascinating dimension that the seminar brought to light.

NUST Student Work for Sustainable Agriculture

The NUST student-Maryam Akhtar worked at Chatha BIO Care Pvt. Ltd, located at National Science & Technology Park (NSTP), where she focused on bio-priming various seeds. Through their work at Chatha BIO Care, they successfully developed a final product known as "Eco seeds." On 25th of August, the student's project was showcased at the hybrid event on 'Agricultural Technologies Innovation for Sustainable Agriculture' held at the Ministry of Foreign Affairs (MOFA) in Islamabad, in collaboration with the Embassy of Switzerland. The event aimed to bring together around 100 science and technology-related stakeholders from Pakistan and Switzerland, both physically and virtually.

Seminar on Soil Management Practices

The NUST Institute of Environmental Sciences & Engineering (IESE) organized a webinar on "Soil Management Practices for CO2 Sequestration." The SDG-15 (Life on Land) and its relationship to soil were the topics of the seminar. Experts talked about environmentally friendly methods to improve soil health for carbon dioxide sequestration.





GOAL 16

Peace, Justice and **Strong Institutions**

Research Projects Publications

92

285

Patents

13

Tracking Suspicious Speech

NUST researcher Mr. Waseem Iqbal, in partnership with IGNITE developed a system for tracking suspicious speech using machine learning; this new technology can play a critical role within addressing hate speech, misinformation, incitement to violence and all significant threats to peace and social cohesion. The project highlights the promotion of peaceful institutions, ones that uphold justice and strong institutional management.

Capacity Building of Afghan Universities Professors

For Afghan professors visiting NUST, the NUST Centre for International Peace & Stability (CIPS) organized a number of capacitybuilding events. On November 22, 2022, at the Jinnah Auditorium CIPS, Mr. Ali Hasnain Sayed, Director NUST Centre for Counselling & Career Advisory (C3A) conducted an orientation session as part of this program. He explained to the attendees the purpose and duties of C3A. Additionally, he examined behavioral changes in pupils that signify psychological distress and gave strategies for coping with at-risk students in the classroom. The event was interactive, and several attendees had questions that were answered at the conclusion.



Character-Building Seminar

NUST Community Services Club invited esteemed guest speaker Tuaha Ibn Jalil to give an interactive session on 'How Failure Builds Character' where students were encouraged to learn from past mistakes. The talk emphasized justice, transparency and accountability as the main measures through which society can hold institutions accountable, along with oneself. The talk was inspiring for students to open their understanding of human rights and equality.



'Reality Check' Seminar Organized by NCBS

NUST Character Building Society organized an interactive seminar where guest speakers Raja Zia, Muhammad Ali and Sobia Talha brought forth insights on freedom of expression within our changing societies. These were accompanied by Ramadan Discussion Sessions where students were encouraged to address personal growth and encouraged to eliminate discrimination and ensure qual opportunities for all. The building of peaceful and inclusive societies happens through these talks where students learn to question their own biases.





GOAL 17

Partnerships for the Goals

Research Projects

41

10 Patents

Document of Understanding (DoU) Signed Between NUST & RESOLVE

On December 15, 2022, the National University of Sciences and Technology (NUST) and RESOLVE signed a memorandum of understanding for the



aim of using the NUST Science & Technology Park (NSTP) services to operate their startup businesses in designated areas. Pro-Rector (RIC), Dr. Rizwan Riaz, and Head of Resolve (Dr. Numan Iqbal) all signed the DoU.

NUST Join Hands with Institute of Business Management (IoBM)

To foster academic cooperation and work together on research initiatives, the Institute of Business Management (IoBM) and National University of Sciences and Technology (NUST) signed a memorandum of understanding MoU on September 1, 2022, the signing ceremony took place at IoBM. The following areas of interest for collaboration with NUST: IT, finance, business management, psychological research, education, and human resources.



The document's signatories were Dr. Rizwan Riaz, pro-rector for research, innovation, and commercialization at NUST, and Mr. Talib Karim, president of the IoBM.

Ajman University Visit to NUST

A high-level delegation from Ajman University visited NUST on 30 June, 2022, led by VC for Academic Affairs Prof Khaled Assaleh. The delegation had a meeting with Rector NUST, followed by a visit to the National Science & Technology Park, engineering schools and labs.



NUST Inked an MoU with NDMA

NUST and NDMA signed an MoU on January 28, 2022 with the goal to create a framework for expanded disaster risk management (DRM) cooperation for research collaborations, knowledge sharing, and scientific and technical partnership for planning for sustainable habitat. The agreement also calls for rigorous stakeholder participation in anticipating and evaluating the effects of climate change in the future and implementing cutting-edge climate strategies for sustainable building design, construction, and planning in Pakistan.





NUST Signed a Project Agreement with Pakistan Microbiological Associates

NUST and Pakistan Microbiological Associates inked a project agreement. The deal aims to establish a cutting-edge R&D facility at NUST for creating diagnostic kits for various ailments. The licensing agreement was signed by Mr. Yasir Aziz, Director PMA Healthcare, and Dr. Rizwan Riaz, Pro Rector of RIC. Both Principal ASAB, Dr. Husnain A. Janjua, and Pro Rector (Academics), Dr. Osman Hasan, attended the ceremony. Dr. Rizwan Riaz, who spoke at the event, underlined the importance of strong industry-academia ties for developing homegrown answers to Pakistan's regional issues and promoting sustainable economic growth.

Strengthening Ties: H.E. Ambassador Khalil Hashmi Visits NUST

H.E. Ambassador Khalil Hashmi, Permanent Representative of Pakistan's Permanent Mission to the United Nations in Geneva, paid a visit to NUST to meet with Dr. Rizwan Riaz, Pro-Rector (RIC). The upcoming



National Summit on Intellectual Property and Brand Protection, which is being organized by the Innovation and Commercialization Directorate in cooperation with the World Intellectual Property Organization and PMG, was the topic of conversation between Ambassador Khalil Hashmi and Dr. Rizwan Riaz. The ambassador plans to return to NUST soon to tour the National Science & Technology Park, SINES, and other facilities there in order to personally experience the potential and capabilities of the institution. Pakistani Intellectual Property Organization.

Report Written and Evaluated By Mr. Zia ur rehman Miss. Verda Hussain NUST Office of Sustainability, RIC National University of Sciences & Technology, H12 44000 Islamabad

🎔 @nustainable

UAN: 111-116-878 🛛 🗭 🖨 🕒 NUST 🗍 🌐 nust.edu.pk Designed & Produced by: NUST Marketing & Communications